

Abstract Data Content Standard for IOOS Data Integration Framework

National Oceanic and Atmospheric Administration
Integrated Ocean Observing System Program
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Contributors

Contact	Organization	Focus Area
Baig, Steve	NWS	Water Temperature, Water Level
Barth, Michael F.	OAR	Winds
Bosch, Julie	NCDDC	Salinity
Burnett, Bill	NDBC	Salinity, Waves
Casey, Ken	NESDIS	Water Temperature
deLaBeaujardiere, Jeff	IOOS	All
Fisher, Kathleen	NOS	Currents
Gill, Stephen	NOS	Water Level
Hardy, Aundrea	CO-OPS	Salinity, Water Level
Harlan, Jack	NOS	Currents
Love, Rebecca	CSC/IMSG	Currents
Martin, Daniel	CSC/IMSG	All
Mendelssohn, Roy	NMFS	Water Temperature
Miller, Patricia A	OAR/MADIS	Winds
Patchen, Richard	CSDL	Water Level, Currents
Saumweber, Whit	ERD	Water Temperature, Salinity
Shuford, Rebecca	NOS	All
Stumpf, Rick	NOS	Water Temperature
Tolman, Hendrik	NWS	Currents
Tomlinson, Shelley	NOS	Currents
Ulmer, John	CSC/PSGS	All
Weeks, Marcia	IOOS	All
Thomas, Julie	Scripps	Waves
Olfe, Corey	Scripps	Waves
Bouchard, Richard	NDBC	Waves

Comments and Change Requests

Contact	Comment	Action
Burnett	NDBC buoy and C-MAN report winds at 10 and 20m, vertical velocity is not reported	informative
Burnett	Winds direction should be defined as the direction the wind is coming from, current direction is the direction the current is going	informative
Burnett	Winds: NDBC does not report vertical wind velocity and therefore this element will be reported as NULL	informative
Casey	Water Temperature: Greater precision is needed in nomenclature to account for SSTskin, SSTsubskin, SSTfoundation etc. GHRSSST/CFNames may offer a name convention.	A vocabulary & dictionary modification will address this
Casey	Water Temperature: Depth is valuable however an actual measurement may not always be the best solution, using a new name as previously mentioned may solve this.	Addressed in previous comment
Casey	Water Temperature: Recommend including uncertainty estimates	Additional work needed
Casey	NODC has vocabularies and defined data structures that may be informative	Informative
deLaBeaujardiere	Consider making the documentation/description element cardinality unbounded	Content is unbounded
deLaBeaujardiere	Consider making the <i>observation Identifier</i> element cardinality unbounded	Content is unbounded
deLaBeaujardiere	Consider using full URN syntax for <i>observation Identifier</i>	Hold, would eliminate org an platform identity
deLaBeaujardiere	Consider registering <i>ioos</i> with the Internet Assigned Numbers Authority	Hold for DES WG
deLaBeaujardiere	See 3/6/2008 email regarding web service requirements	Hold for DES WG
deLaBeaujardiere	Consider better defining the documentation element to include subtypes	Hold for metadata discussion
deLaBeaujardiere	Consider setting the winds vertical velocity element as optional	Completed
deLaBeaujardiere	Consider adding an element or service to record precision	Hold for DES WG
Fisher, Kathleen	Currents: Prefer vertical positions referenced to water surface	Informative
Harlan, Jack	Make the vertical datum and vertical position optional for HR Radar entries	Completed

Martin	Rename select elements to match Observation and Measurement Specification	Completed
Martin	Add the <i>Feature of Interest</i> element from the Observation and Measurement Specification	Completed
Martin	Provide descriptive titles to each element in the data dictionary for ease of the reader	Completed
Mendelssohn	Consider cross referencing and evaluating: ARGO, COADS, WOA, WODB, WOCE, GLOBEC, CF, CSML and others	Informative
Mendelssohn	Providing more metadata in each data payload, even when it is possibility duplicative with related metadata resources can be advantageous	Informative
Miller/Barth	Winds: Radiosonde profile horizontal locations will vary on a per record basis. Measurement counts are approximately 50 per event	Informative
Miller/Barth	Winds: Profiler horizontal location is static, measurement counts are approximately 50 per event	Informative
Miller/Barth	Winds: vertical wind (W) is an important scalar value that needs to be reported	Informative
Miller/Barth	Winds: in addition to the instrument vertical height and its vertical datum, consider adding the "above ground level" measurement	Completed
Patchen, Richard	Salinity: A collection event element may assist in identifying additional observed properties collected concurrently	Hold for DES WG
Patchen, Richard	Water Level: Consider adding the epoch date	Completed
Patchen, Richard	Currents: Include a bin width and total water depth	Completed
Patchen, Richard	Currents: Include the surface as a vertical reference	Completed
Saumweber, Whitley	Salinity: Consider adding a conductance value	Hold, additional work needed
Stumpf, Rick	Water Temperature: Recommend including uncertainty estimates	Additional work needed

Future Work

1. Comment and change request actions noted as “Hold for data encoding and services work group” indicate that the issue is best resolved when considering data structure and format.
2. Some data dictionary entries list an “encoding tag” designation; this specifies encoding recommendations for XML implementations only.

References

Federal Register Notice – Affirmation of Datum for Surveying and Mapping Activities; June 14, 1989 (NAD83)

Federal Register Notice – Affirmation of Vertical Datum for Surveying and Mapping Activities; June 24, 1993 (NAVD 88)

ISO 8601:2000, Data elements and interchange formats – information interchange – Representation of dates and times

ISO 6709:1983, Standard representation of latitude, longitude and altitude for geographic point locations

OGC 07-022r1 Observation and Measurements – Part 1 Observation schema

Other Resources

ArcGIS Marine Data Model, <http://dusk2.geo.orst.edu/djl/arcgis/>

Argo Data Management Handbook
http://www.coriolis.eu.org/cdc/argo/argo_data_management_handbook.pdf

CF Metadata, <http://cf-pcmdi.llnl.gov/>

International Comprehensive Ocean-Atmosphere Data Set (COADS)
<http://icoads.noaa.gov/products.html>

NOAA Center for Operational oceanographic Products and Services,
<http://tidesandcurrents.noaa.gov/>

NOAA National Data Buoy Center – Measurement Descriptions and Units,
<http://www.ndbc.noaa.gov/measdes.shtml>

OceanSITES, <http://www.oceansites.org/data/index.html>

U.S. Environmental Protection Agency Central Data Exchange,
<http://www.epa.gov/cdx/>

U.S. GLOBEC, <http://www.usglobec.org/data.php#guidelines>

U.S.G.S. Real-Time water Data for the Nation,
<http://waterdata.usgs.gov/nwis/rt>

U.S. JGOFS, http://www1.whoi.edu/general_info/data_management.html

World Ocean Atlas, http://www.nodc.noaa.gov/OC5/WOA05/pr_woa05.html

World Ocean Database, http://www.nodc.noaa.gov/OC5/WOD05/pr_wod05.html

World Ocean Circulation Experiment (WOCE),
<http://www.nodc.noaa.gov/WOCE/>

Abstract Data Content Overview - water temperature example

Element	Example	Definition
*Feature of Interest	Boston Harbor	Object observed
Documentation	http://Address/docs/iso001.xml	Reference to metadata
*Instrument	NDBC:platform123:sensor123	Identifies source
Sample Interval	360	In seconds
Processing Level	raw	Status/quality of result
Vertical Datum	MLLW	Origin for vertical measures
*Observed Property	waterTemperature	Parameter or variable name
Latitude	42.1234	Decimal degrees
Longitude	-72.2345	Decimal degrees
Vertical Position	6.4	Decimal meters
*Date and Time	1007-10-04T12:01:02Z	ISO 8601
*Result	18.34	Value of measurement
Units	degreeCelsius	Unit of measure

* indicates elements defined by the Observation and Measurement Specification.

Data Dictionary

FEATURE OF INTEREST

Description: Defines the phenomena or object that is observed
Data Type: xsd:string
Length: N/A
Units: N/A
Domain: Unbounded
Example: Boston Harbor
Obligation: Mandatory
Occurrence: 1
Encoding Tag: <om:featureOfInterest>
Reference: OGC 07-022r1, Observation and Measurement – Part 1
Notes:

DOCUMENTATION

Description: Contains a simple text description of the object, or refers to an external schema – of additional documentation
Data Type: gml:StringOrRefType
Length: N/A
Units: N/A
Domain: Unbounded
Example: http://organization.url/metadata/file.xml
Obligation: Optional
Occurrence: 1 or more
Encoding Tag: <gml:description>
Reference: ISO_DIS_19136 and OGC 07-036
Notes:

INSTRUMENT

Description: identifies the source organization, platform and device employed for the observation, collection or modeled event
Data Type: xsd:string
Length: 128
Units: N/A
Domain: Unbounded between colon separators
Example: NERACOOS.GOMOOS:A001:DeviceABC
Obligation: Mandatory
Occurrence: 1
Encoding Tag: <om: procedure>
Reference: OGC 07-022r1, Observation and Measurement – Part 1
Notes: The content inside each branch of the entry is defined by data provider conventions. Use of consistent patterns between entries is encouraged.

SAMPLE INTERVAL

Description: Defines the time frame that measurements were taken to derive the reported result
Data Type: xsd:integer
Length: 8
Units: seconds
Domain: 0 to 99,999,999
Example: 3600
Obligation: Mandatory
Occurrence: 1
Encoding Tag: <iios: sampleInterval>
Reference: OGC 07-022r1, Observation and Measurement – Part 1
Notes:

PROCESSING LEVEL

Description: Defines the status of the result as defined by data provider classifications
Data Type: xsd:string
Length: 64
Units: N/A
Domain: Unbounded
Example: Raw
Obligation: Mandatory
Occurrence: 1
Encoding Tag: <ioos:processingLevel>
Reference:
Notes: A URN entry with reference to a dictionary is a possible implementation

VERTICAL DATUM

Description: Defines the origin for vertical measurements
Data Type: xsd:string
Length: 32
Units: N/A
Domain: Enumerated in the dictionary in Appendix B
Example: LMSL
Obligation: Mandatory, with exception for HF Radar
Occurrence: 1
Encoding Tag: <ioos:verticalDatum>
Reference: Federal Register Vol. 54, No. 112 and Vol. 58, No. 120
Notes: Dictionary entries are normative

OBSERVED PROPERTY

Description: Defines the parameter or variable measured or calculated
Data Type: xsd:string
Length: 64
Units: N/A
Domain: Enumerated in the dictionary in Appendix B
Example: waterTemperature
Obligation: Mandatory
Occurrence: 1
Encoding Tag: <om:observedProperty>
Reference: OGC 07-022r1, Observation and Measurement – Part 1
Notes: Dictionary entries are informative

LATITUDE

Description: Northing value for horizontal position of the observation
Data Type: gml:PointPropertyType
Length: NA
Units: Decimal Degrees, WGS84
Domain: 0 to -90, 0 to 90
Example: 88.12345
Obligation: Mandatory
Occurrence: 1
Encoding Tag: <gml:pos>
Reference: ISO_DIS_6709
Notes: Positive sign inferred. Values south of the equator shall include the negative sign. The number of decimal places communicates the accuracy of the position. See EPSG version 6.6 4326

LONGITUDE

Description: Easting value for horizontal position of the observation
Data Type: gml:PointPropertyType
Length: NA
Units: Decimal Degrees, WGS84
Domain: 0 to -180, 0 to 180
Example: -170.12345
Obligation: Mandatory

Occurrence: 1
 Encoding Tag: <gml:pos>
 Reference: ISO_DIS_6709
 Notes: Positive sign inferred. Values west of the prime meridian shall include the negative sign. Note that the number of decimal places communicates the accuracy of the position. See EPSG version 6.6 4326

VERTICAL POSITION

Description: Vertical position of the observation where positive is above datum
 Data Type: gml:MeasureType
 Length: N/A
 Units: Meters
 Domain: -9999.99 to 9999.99
 Example: -123.12
 Obligation: Mandatory, with exception for HF Radar
 Occurrence: 1
 Encoding Tag: <ioos:verticalPosition>
 Reference:
 Notes:

DATE AND TIME

Description: Date and time of an observation; may be used to indicate a time range over which period observations are calculated
 Data Type: xsd:dateTime
 Length: N/A
 Units: N/A
 Domain: N/A
 Example: 2008-02-10T09:49:16.1Z
 Obligation: Mandatory
 Occurrence: N
 Encoding Tag: <om:samplingTime>
 Reference: ISO 8601, Observation and Measurement – Part 1
 Notes:

RESULT

Description: The measured, collected or modeled value
 Data Type: gml:MeasureType
 Length: 64
 Units: N/A
 Domain: Unrestricted
 Example: 19.5
 Obligation: Mandatory
 Occurrence: N
 Encoding Tag: <om:result>
 Notes: The term and data type may need to be modified to account for complex values

UNITS

Description: Defines the units of measure for the observation
 Data Type: Character string, case sensitive
 Length: 64
 Units: N/A
 Domain: Bounded to the dictionary entries in Appendix C
 Encoding Tag: contained within the <om:result>

Appendix A - Examples

TABLE A.1 Overview of minimum **water temperature** record

Parameter	Example
Feature of Interest	Boston Harbor
Documentation	http://Address/docs/iso001.xml
Instrument	NDBC:platform12345:SensorABC
Sample Interval	360
Processing Level	raw
Vertical Datum	MLLW
Observed Property	waterTemperature
Latitude	42.1234
Longitude	-72.2345
Vertical Position	6.4
Date and Time	1007-10-04T12:01:02Z
Result	18.34
Units	degreeCelsius

TABLE A.2 Overview of a minimum **salinity** record

Parameter	Example
Feature of Interest	Boston Harbor
Documentation	http://Address/docs/iso001.xml
Instrument	NDBC:platform12345:SensorABC
Sample Interval	360
Processing Level	preliminary
Vertical Datum	MLLW
Observed Property	salinity
Latitude	42.1234
Longitude	-72.2345
Vertical Position	6.4
Date and Time	1007-10-04T12:01:02Z
Result	32.123
Units	psu

TABLE A.3 Overview of a minimum **water level** record

Parameter	Example
Feature of Interest	Boston Harbor
Documentation	http://Address/docs/iso001.xml
Instrument	NDBC:platform12345:SensorABC
Sample Interval	360
Processing Level	certified
Vertical Datum	MLLW
Observed Property	waterLevel
Observed Property	epoch
Latitude	42.1234
Longitude	-72.2345
Vertical Position	3.45
Date and Time	1007-10-04T12:01:02Z
Result	tuple
Units	meter

TABLE A.4 Overview of a minimum **currents** record

Parameter	Example
Feature of Interest	Boston Harbor
Documentation	http://Address/docs/iso001.xml
Instrument	NDBC:platform12345:SensorABC
Sample Interval	360
Processing Level	experimental
Vertical Datum	MLLW
Observed Property	currentDirection
Observed Property	currentSpeed
Observed Property	binWidth
Observed Property	totalWaterDepth
Latitude	42.1234
Longitude	-72.2345
Vertical Position	6.4
Date and Time	1007-10-04T12:01:02Z
Result	tuple of scalar values
Units	degreeTrue and cm/s

TABLE A.5 Overview of a minimum **winds** record

Parameter	Example
Feature of Interest	Boston Harbor
Documentation	http://Address/docs/iso001.xml
Instrument	NDBC:platform12345:SensorABC
Sample Interval	360
Processing Level	RAW
Vertical Datum	MLLW
Observed Property	windDirection
Observed Property	windSpeed
Observed Property	windGust
Observed Property	windVerticalVelocity
Observed Property	heightAGL
Latitude	42.1234
Longitude	-72.2345
Vertical Position	20
Date and Time	1007-10-04T12:01:02Z
Result	tuple of scalar values
Units	See dictionary entries

TABLE A.6a - Overview of a minimum **non-directional waves** record

Parameter	Example
Feature of Interest	Boston Harbor
Documentation	http://Address/docs/iso001.xml
Instrument	NDBC:platform12345:SensorABC
ReportingInterval	360 (cf. SamplingInterval in 6b)
Processing Level	RAW
Latitude	42.1234
Longitude	-72.2345
Vertical Datum	MLLW
Vertical Position	20
Date and Time	2008-04-01T12:34:56Z
Observed Property	significantWaveHeight (float)
Observed Property	dominantWavePeriod (float)
Observed Property	averageWavePeriod (float)
Observed Property	swellHeight (float)
Observed Property	swellPeriod (float)
Observed Property	windWaveHeight (float)
Observed Property	windWavePeriod (float)
Observed Property	waterTemperature (float)
Observed Property	waveDuration (float)
Observed Property	calculationMethod (string: 1,2,3,4)
Observed Property	samplingRate (float)
Observed Property	numberOfFrequencies (integer)
Observed Property	centerFrequencies (list of floats)*
Observed Property	bandwidths (list of floats)*
Observed Property	spectralEnergy (list of floats)*
Units	See dictionary entries

* NOTE: The number of entries in the list is given by numberOfFrequencies.

TABLE A.6b - Additional fields for **directional waves** record

Parameter	Example
Observed Property	meanWaveDirection (float)
Observed Property	swellDirection (float)
Observed Property	windWaveDirection (float)
Observed Property	directionalWaveParameter (list of floats)*
Observed Property	FourierCoefficientA1 (list of floats)*
Observed Property	FourierCoefficientB1 (list of floats)*
Observed Property	FourierCoefficientA2 (list of floats)*
Observed Property	FourierCoefficientB2 (list of floats)*
Units	See dictionary entries

* NOTE: The number of entries in the list is given by numberOfFrequencies.

Appendix B

TABLE B.1 – Vertical datum code list - normative

Category	Name	Definition
Orthometric	NAVD88	North American Vertical Datum 1988
Orthometric	NGVD29	North American Geodetic Vertical Datum 1929
Tidal	MLLW	Mean Lower Low Water
Tidal	MLW	Mean Low Water
Tidal	LMSL	Local Mean Sea Level
Tidal	MTL	Mean Tide Level
Tidal	DTL	Diurnal Tide Level
Tidal	MHW	Mean High Water
Tidal	MHHW	Mean Higher High Water
Ellipsoidal	NAD83	North American Datum 1983 (1986)
Ellipsoidal	WGS84(G1150)	World Geodetic System 1984 (G1150)
Ellipsoidal	WGS84(G873)	World Geodetic System 1984 (G873)
Ellipsoidal	WGS84(G730)	World Geodetic System 1984 (G730)
Ellipsoidal	WGS84	World Geodetic System 1984 (original system – 1984)
Ellipsoidal	WGS72	World Geodetic System 1972
Ellipsoidal	ITRF2000	International Terrestrial Reference Frame 2000
Ellipsoidal	ITRF97	International Terrestrial Reference Frame 1997
Ellipsoidal	ITRF96	International Terrestrial Reference Frame 1996
Ellipsoidal	ITRF94	International Terrestrial Reference Frame 1994
Ellipsoidal	ITRF93	International Terrestrial Reference Frame 1993
Ellipsoidal	ITRF92	International Terrestrial Reference Frame 1992
Ellipsoidal	ITRF91	International Terrestrial Reference Frame 1991
Ellipsoidal	ITRF90	International Terrestrial Reference Frame 1990
Ellipsoidal	ITRF89	International Terrestrial Reference Frame 1989
Ellipsoidal	ITRF88	International Terrestrial Reference Frame 1988
Ellipsoidal	SIOMIT92	Scripps/MIT 1992
Ellipsoidal	NEOS90	National Earth Orientation Service 1990
Ellipsoidal	PNEOS90	Preliminary National Earth Orientation Service 1990
na	WaterSurface	Free Surface

TABLE B.2 – Code list for meteorological names with common units of measure -
informative

Name	Units
airPressure	hPA
airTemperature	degreeCelsius
dewPointTemperature	degreeCelsius
heightAGL	meter
relativeHumidity	percent
solarRadiation	watts/m2
visibility	statute miles
precipitation	mm
windSpeed	m/s
windDirection	degreeTrue
windGust	m/s
windVerticalVelocity	m/s

TABLE B.3 – Code list for oceanographic names with common units of measure - informative

Name	Units
binWidth	meter
chlorophylla	ug/l
chlorophyllb	ug/l
conductivity	milliSiemens/cm
currentDirection	degreeTrue
currentSpeed	cm/s
dissolvedOxygen	percent
fluorescence	generic fluorescence units
oceanColor	
salinity	psu
seaIceCover	
seaIceThickness	
totalWaterDepth	meter
totalSuspendedSolids	mg/l
turbidity	ftu
epoch	string
waterLevel	meter
waterTemperature	degreeCelsius
significantWaveHeight	meters
dominantWavePeriod	seconds
averageWavePeriod	seconds
swellHeight	meters
swellPeriod	seconds
windWaveHeight	meters
windWavePeriod	seconds
waveDuration	seconds
calculationMethod	(string: 1, 2, 3, 4)
samplingRate	Hz
numberOfFrequencies	(integer)

centerFrequencies	Hz
bandwidths	Hz
spectralEnergy	meter*meter/Hz
meanWaveDirection	degreeTrue
swellDirection	degreeTrue
windWaveDirection	degreeTrue
directionalWaveParameter	degreeTrue
FourierCoefficientA1	(dimensionless)
FourierCoefficientB1	(dimensionless)
FourierCoefficientA2	(dimensionless)
FourierCoefficientB2	(dimensionless)